DESIGN, FABRICATION & TESTING OF ALIGNMENT TEST SET UP

Bachelor of Technology
in
Mechanical Engineering
by

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111ME0339

UNDER the guidance
Of
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2014-15

CERTIFICATE

This is to certify that the work in this thesis entitled "Design, Fabrication and Testing Of Shaft-alignment test set up" by Vivek Kumar Ranjan, has been carried out under my supervision in partial fulfilment of the requirements for the degree of Bachelor of Technology in Mechanical Engineering during session 2014-2015 in the Department of Mechanical Engineering, National Institute of Technology Rourkela.

To the best of my knowledge, this work has not been submitted to any other University/Institute for the award of any degree or diploma.

Place: Rourkela

Date:

Professor Sukesh Chandra Mohanty

(Supervisor)

Department of Mechanical Engineering

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ABSTRACT

Proper alignment of rotating device has long ago been identified as a pre-requisite to safe and reliable uses. Loud noise levels, frequently vibrating floors, fiasco of bearings and lubrication system are the types of machine breakage that are the results of the shaft misalignment. To get efficient torque and hence power transfer, shaft alignment plays a crucial role like while connecting to a motor and pump in any kind of industrial usage. Achieving proper alignment involves far more than merely setting the machines so that the shafts remain coaxial. This involves the designing and implementation of devices and of the apparatus into which the equipment is integrated. Here, first we have worked on the importance as well as methods of the alignment and various type of misalignments and measuring it with several tools. To replicate the motor-pump setting, an experimental set up is constructed in a driver and a driven motor which are connected with each other by flange coupling. Proper shaft alignment is done with the help of different alignment devices and readings leading us to the efficiency of power transfer.

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Chapter – 1
INTRODUCTION

1.1 Alignment:

1. **Definition**:

Shaft-alignment is a procedure where two or more machineries, generally a motor and pump, are oriented within a tolerated margin such that at the point of power and torque transfer between the two shafts, the rotational axes of both shafts should be aligned coaxially when the machine is operated under usual condition.

While the machine is under running condition, some factors also affect the alignment condition that has been measured before the starting of the machinery. A few of those reasons can be excess piping strain, movement of the foundation, thermal growth of machine parts, bearing load, torque variation of machinery. Also alignment measurement should be done while the shafts are turning in their normal direction of rotation.

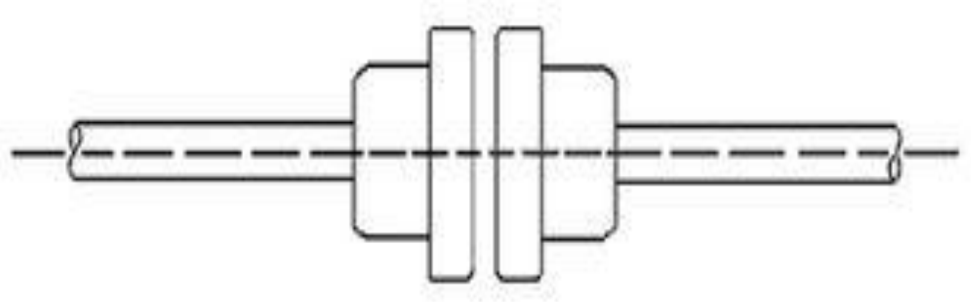
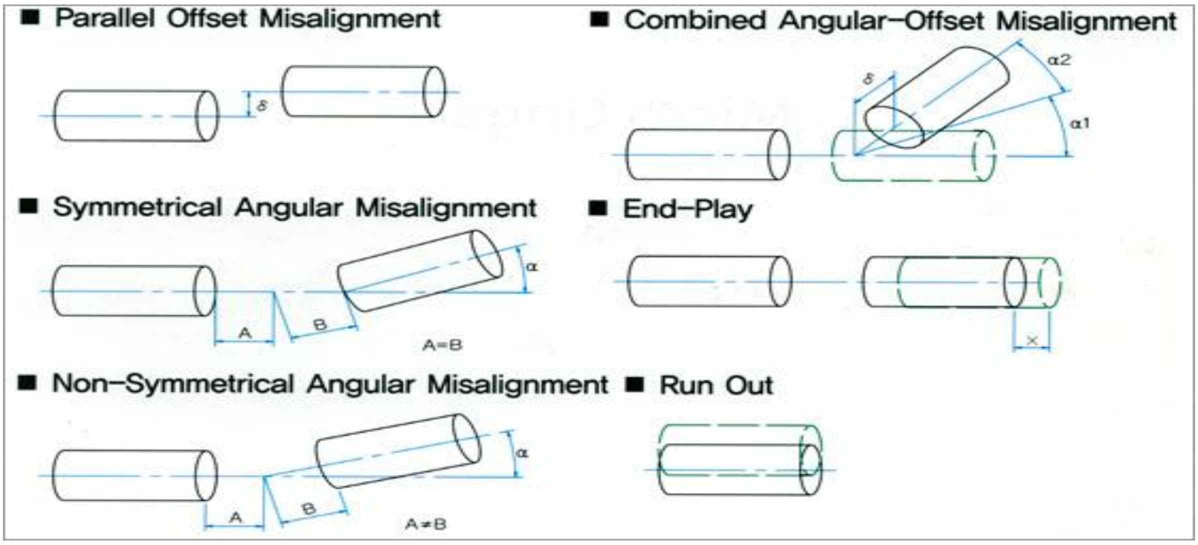
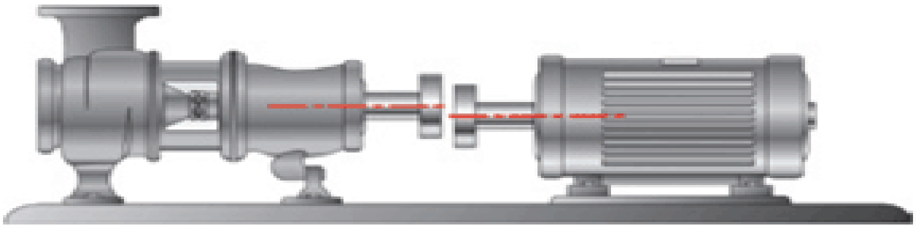


Figure 1: Coaxial Alignment

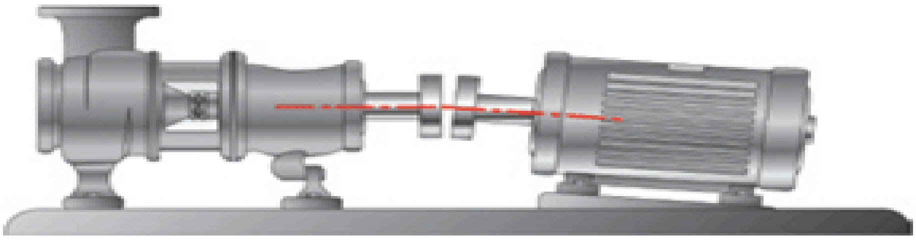
2. **Categories of misalignment**:

Shaft-misalignment are divided into two categories: parallel or offset type and angular type. Both of the categories can be observed in the vertical as well as the horizontal planes. Usually both angular and parallel type misalignment is observed in any of the two directions. Hence for proper alignment of shafts we have to perform the experiment in both directions.

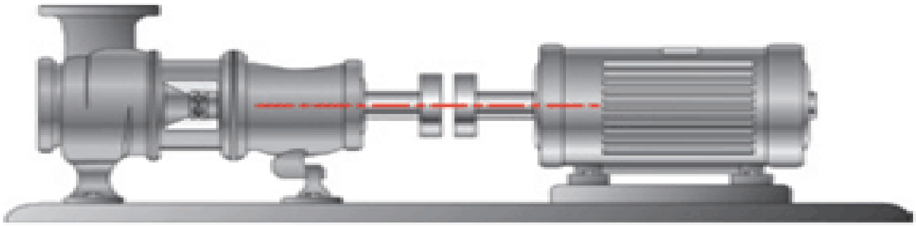




Parallel or offset misalignment



Angular misalignment



Correct alignment

3. Reasons of misalignment:

Main reasons of misalignments in shafts are movement of one part of device in respect to another because of temperature increment in one or both equipments, piping strains or strain actuated by electrical associations, Torsional development occurring at start-up or while working, displacement or settling of the establishment or baseplate, Inaccurate or inadequate arrangement strategies (human slip), mis-bored couplings etc.

Any of the above conditions will significantly influence the arrangement of set-up. In the event in case more than one of the conditions exists, the chances are profoundly against a machine running easily, discreetly, or for any obvious measure of time. Strictly when the majority of the circumstances have been analyzed and revised can a craftsperson be guaranteed of a precise arrangement occupation being attained and kept up as desired.

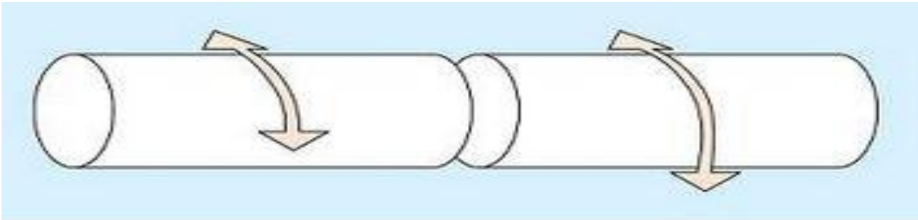


Figure 4: Torsional Effect

4. **Consequences of misalignment**:

The impacts of misalignment are surrounding us in an office. High commotion levels or always vibrating floors are solid evidences of conceivable misalignment of hardware. A percentage of alternate impacts can be: loss in generation of products, low quality items, higher than typical repair requests, expanded extra parts buys and stock available, decreased benefits.

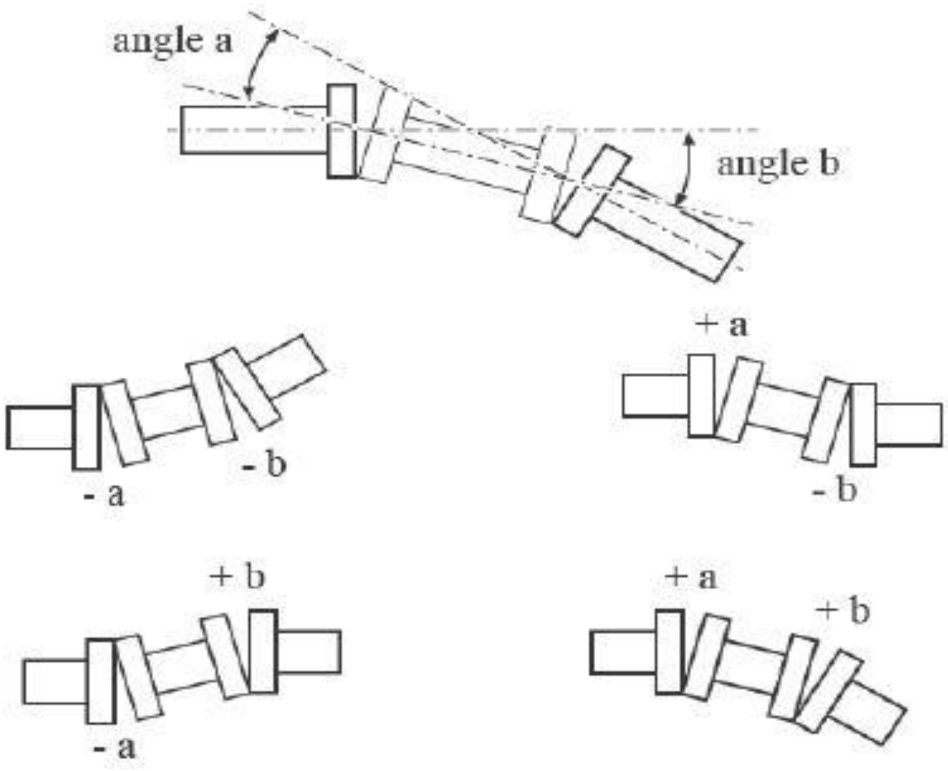
Notwithstanding the budgetary effect on the organization, the immediate impact on the different machine parts can be impressive. Bearing operating temperature will exceed, making them come up short rashly. Mechanical seals, seal rings, and pressing will spill. Loss of item and grease can happen. Couplings will come up short because of unnecessary strain on the centers. In extreme cases, shafts can break, bringing about far reaching harm to machineries.

5. Detection of misalignment:

Misalignment in pivoting hardware can be recognized in various ways. A few strategies are fused into the plants deterrent support program. Others are examinations that could be utilized all the time yet for the most part are performed after the hardware has fizzled. A percentage of the signs of misalignment are: wobbling of shafts, unreasonable vibration, exorbitant bearing temperature, commotion, bearing deterioration pattern, coupling wear etc.

6. Spacer shafts:

Normally spacer-shafts are introduced when critical arrangement changes are foreseen amid operation of the machine, for instance because of warm development. Through the length of spacer shaft, the rakish change at the spacer shaft end stays little notwithstanding when bigger machine positional changes happen. The arrangement exactness for machine fitted with spacer shafts that have adaptable components at every end is not as basic concerning machines that have short adaptable couplings introduced. Edges are measured between the spacer shaft pivot hub and the particular machine's axis of rotation.

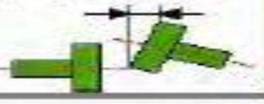


7. Tolerances:

Consider all qualities to be the greatest passable deviation from the arrangement target, be it zero or some wanted value to make up for warm development. By a large a speedy look at the table will tell whether coupling misalignment is admissible or not.

For spacer shafts the table gives greatest passable offset for 1 inch of spacer shaft length. Case in point, a machine running at 180 rpm with 10 inch of spacer shaft length would permit a greatest counterbalance of about 60 mils at either coupling at the finishes of the spacer shaft.

Suggested alignment tolerance table

	RPM	metric (mm)		inch (mils)	
		Acceptable	Excellent	Acceptable	Excellent
Short "flexible" couplings					
Offset:	600			9.0	5.0
	750	0.19	0.09		
	900			6.0	3.0
	1200			4.0	2.5
	1500	0.39	0.06		
	1800			3.0	2.0
	3000	0.36	0.03		
	3600			1.5	1.0
	6000	0.33	0.02		
	7200			1.0	0.5
Angualrity	600			15.0	10.0
Metric values—Gap difference per 100 mm coupling diameter	750	0.13	0.09		
	900			10.0	7.0
	1200			8.0	5.0
Inch values—Gap difference per 10 inch coupling diameter	1500	0.37	0.05		
	1800			5.0	3.0
	3000	0.34	0.03		
	3600			3.0	2.0
	6000	0.33	0.02		
	7200			2.0	1.0
Spacer shafts and membrane (disc) couplings	600			3.0	1.8
	750	0.25	0.15		
	900			2.0	1.2
Metrics values—Offset per 100 mm spacer shaft	1200			1.5	0.9
	1500	0.12	0.07		
Inch values—Offset per inch spacer length	1800			1.0	0.6
	3000	0.07	0.04		
	3600			0.5	0.3
	6000	0.03	0.02		
	7200			0.3	0.2
Soft-foot	Any	0.06		2	

OBJECTIVES

- Basic study of shaft alignment and different types of shaft misalignments.
- Basic study of alignment tools and methods of alignment.
- Basics of ‘Flange coupling’.
- Getting the proper dimensions of experimental setup components by machining and buying the required components with corresponding specifications.
- Checking the working status of apparatus.
- Alignment of shafts with the help of various alignment tools.
- Carrying out the experiment and observing the required readings.
- Result and conclusion of the experiment.

Chapter – 2
Literature review

The shaft arrangement applies for the area of the principle motor driving tomahawks, transitional orientation hub and stern tube bearing hub. The primary point of the shaft line and course are the able loadings on to the shaft line bearings. Shafting system is a critical piece of the boat force plant, including the propeller shaft, tail shaft, centre shaft, push shaft, the bearing parts and so on. During the time spent boat cruising, because of the impact of hydrodynamic power, bearing power , miss-happening of boat shafting and some different variables, the shafting vibration issue will happen inexorable, and afterward it will influence the security and dependability of the boat drive framework , at last it will influence the typical route of the boat.

Research on shafting arrangement is a vital subject in the field of boat, numerous researchers have mulled over it, Lech Murawski from Poland has examined the pole line arrangement under the thought of boat development adaptability and disfigurements.

K.H. Low of Singapore had examined the arrangement strategy for the surface specialties and so forth. The shafting arrangement can change the power of bearing, the edge and state of the shaft line. It will influence the vibration qualities of the shaft, as well. Consequently it is important to study the impact of arrangement on the shaft vibration. Jarysz Kaminska, Sighted through as hint of shaft arrangement process. His paper presents picked exercises of the boats impetus framework shafting alignment procedure. The fundamental concentrate in his paper was put on locating through (bore locating) which could be possible with three unique sorts of estimation gear: piano were, optical instruments and laser instruments. The investigation of estimation gear permits determination of most ideal estimation answer for organization. The matter of this determination is to stay away from peril to the pole line because of shafts misalignment. Displayed in paper measuring systems and estimation hardware which is being utilized for locating trough the components of boats impetus framework meet innovative necessities asked for by the customer and by the boat grouping society.

There was a shaft alignment checklist conducted by Paul Berberian where he emphasized by saying that Before you take off of the shop to adjust a bit of pivoting hardware, a little pre-alignment arranging will make the employment go smoother and resulting in a superior result The checklist given by Paul Berberian can be mentioned in following points written below:

Review the lockout tag out methods in influence at your office. Remember to consider all potential vitality sources in your arranging. Check for the maker's arrangement details, survey and focus your resilience for the mobile machines and what kind of coupling is being utilized. Do you have a supply of good quality shims? We prescribe precut stainless steel shims, with real thickness markings to abstain from stacking resistances in the field. Be arranged to clean the hardware bases and feet, examine the plinth or docks if any. A quality arrangement can not be made on a disintegrating establishment. Keep in mind funnel strain or different powers that can influence the stationary gear. Is your arrangement gear in great condition? Do you have all the sections or apparatuses you may need including a magnet base and dial marker to check for shaft and coupling "run out". Do you have the correct hardware to move the apparatus as required? Lifting bars, water driven lifting gadgets and convenient jack jolts can spare a considerable measure of time and enhance exactness, without mounted jack jolts. You ought to know arrangement resilience for the machine, cool misalignment balances coupling crevice and whenever confinements. You ought to check for coupling and shaft run out.

Chapter – 3

ALIGNMENT TOOLS

3.1 Accessories of different alignment

There is a huge number of strategies accessible to perform precise arrangement, any of which can convey the fancied result. Then again, a few exactness devices are regularly utilized as a part of arrangement work. dial markers, parallel squares, decrease gages, antenna gages, a measuring tape, a 6-inch standard, and a little reflect are all helpful. Everyone has a part to play in doing arrangements.

3.2 Dial Indicator

Dial markers are most likely the most generally utilized accuracy instruments. They are accessible in different styles, sizes, and extent. A back plunger sort, indicated in Figure 5, is regularly used to take edge and face readings on couplings, to quantify delicate foot, and to screen exact machine moves. Their little size makes them simple and advantageous to utilize.

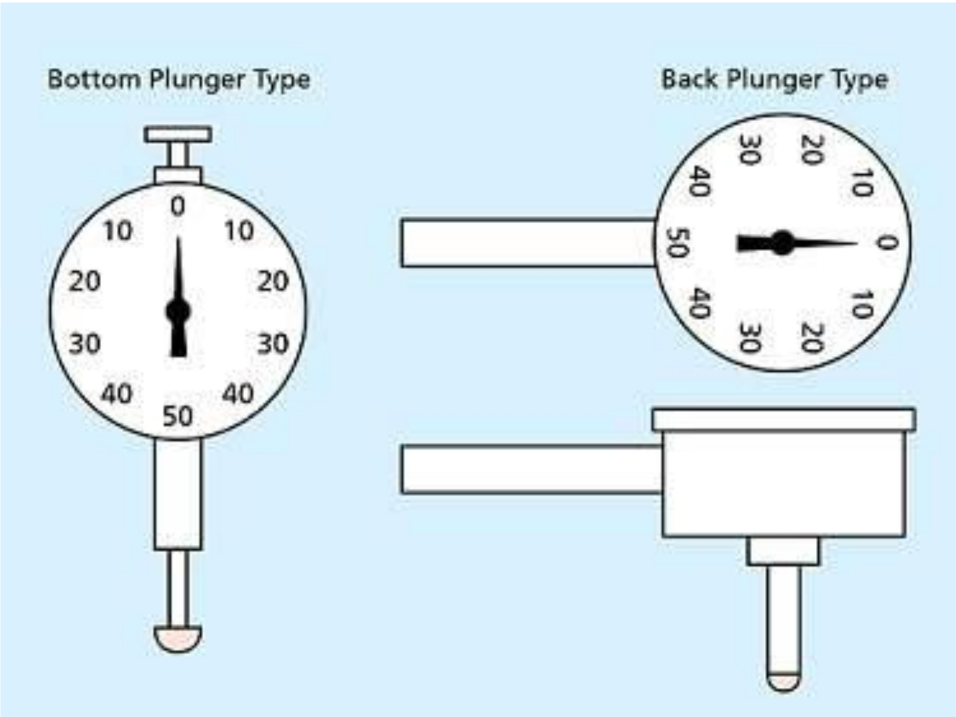


Fig. 5

Base plunger style pointers are utilized for taking run out readings on couplings and shafts, and for measuring misalignment. They come in two styles: adjusted or ceaseless perusing. Samples of both are demonstrated in Figure 6. The dials are 1 inch in breadth or 2.125 inches in distance across. Their usable reach is from 0.250 inches to as much as 12 inches. Commonly, a 0.0250 inches or 0.500 inches travel pointer is utilized as a part of arrangement work.

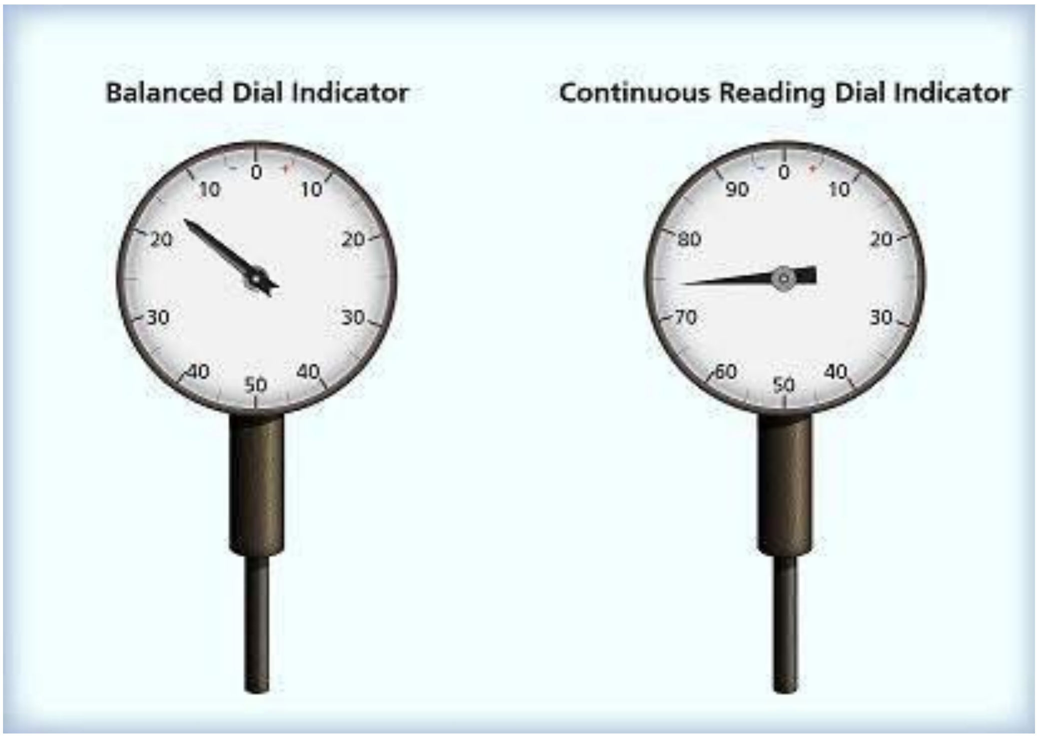


Fig. 6

3.3 Parallel

Movable, or sliding, parallels, demonstrated in Figure 7, are utilized to gauge crevices or gaps. They more often than not are accessible in sets. Sliding parallels shift long from 1 to 5.065 inches, are 9/32 inches thick, and can gauge ranges such from 0.375 inch to 1- 2 inches. To check the measure of a crevice, the sliding parallel is embedded and extended to the best possible size. The parallel then is measured with an outside micrometre to focus the hole size. Sliding parallels can be utilized to take coupling centre face readings.

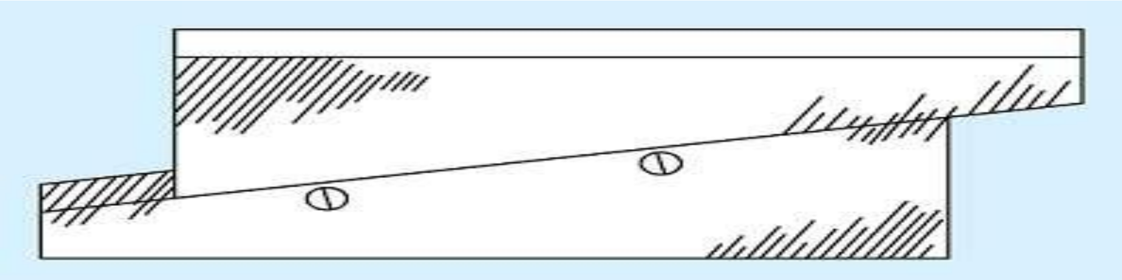


Fig. 7

3.4 Thickness Gauge

The standard thickness gage, likewise called an antenna gage is a minimal get together of top notch, warmth treated steel leaves of different thicknesses, as demonstrated in Figure 8. The leaves for the most part differ in thickness by .001 inches, and the definite thickness of every leaf is stamped on its surface.

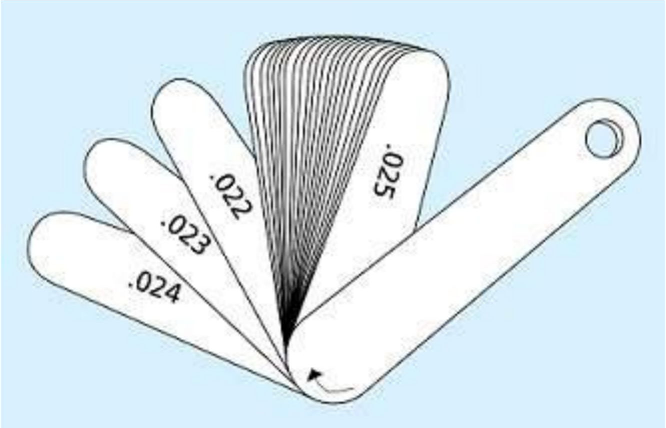


Fig. 8

A thickness gage is the measuring instrument normally used to focus the exact measurement of little openings or holes, for example, those that must be measured over the span of adjusting a coupling. To focus the measurement of an opening or crevice, the steel leaves are embedded independently or in mix until a leaf or blend is discovered that fits cosily. The measurement is then learned by the figure stamped on the leaf surface or, if a few leaves are utilized, by totalling the surface figures. Another sort of thickness gage, not as generally known or utilized but rather preferably suited for coupling arrangement, is the decrease gage, indicated in Figure 9. It is at times alluded to as a hole gage. Its foremost preference for coupling arrangement is that it gives an immediate perusing and does not oblige experimentation "feeling" to focus an estimation. The instrument end is embedded into an opening, or hole, and the opening size is perused on the graduated face. Two estimation frameworks inch and metric are demonstrated.

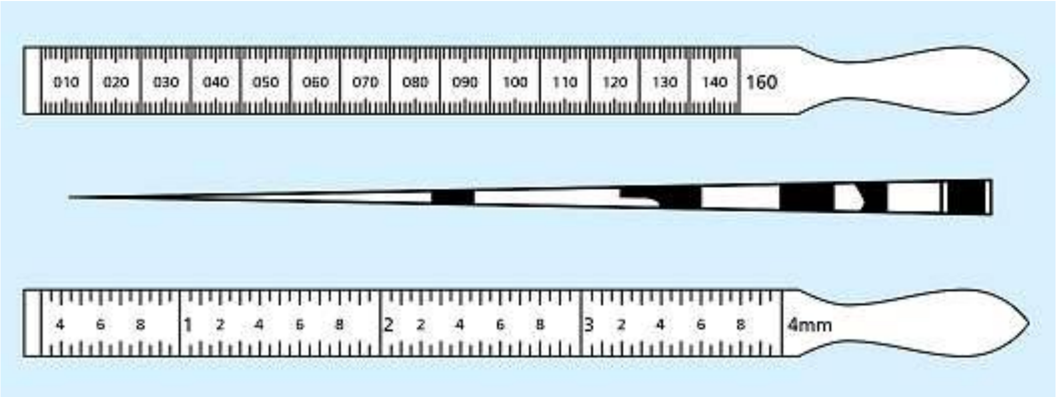


Fig. 9

3.5 Micrometer

Another accuracy measuring instrument utilized for coupling arrangement is the outside micrometer calliper demonstrated in Figure 10. As its name infers, it is utilized to quantify outside measurements.

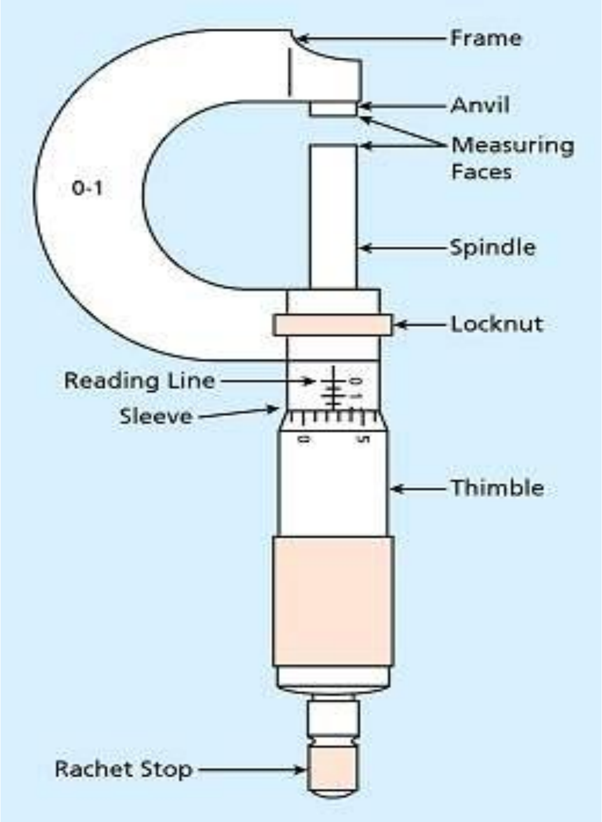


Fig. 10

Outside micrometers are accessible as single units or as complete sets. A complete arrangement of micrometers issues you the upside of having the capacity to rapidly pick the micrometer proper for a particular circumstance. Two sorts of micrometer sets are by and large accessible. One contains numerous micrometers of distinctive sizes with a mixture of edges. Such sets may contain anywhere in the range of 3 to 24 micrometers and have extents shifting from 0 to 3 inches up to 0 to 24 inches. Diverse mixes of a fastener stop or grinding thimble and lock nut may be given on micrometers in these sets. Micrometer arrangements of this sort may be graduated in thousandths of an inch, ten-thousandths of an inch, or hundredths of a millimeter. The second kind of outside micrometer set, represented in Figure 11, contains an outside micrometer with tradable iron blocks and an arrangement of principles. Micrometers of this sort range from 0 to 4 inches up to 20 to 24 inches and are likewise accessible with Metric alignments. An outside micrometer with exchangeable iron blocks is every now and again utilized as a part of the field to quantify objects of fluctuating sizes. The micrometer has a flexible stop on the iron block to change the general iron block measurements. Both sorts of micrometer sets are fit for measuring inside the same size range and delivering results with equivalent precision.

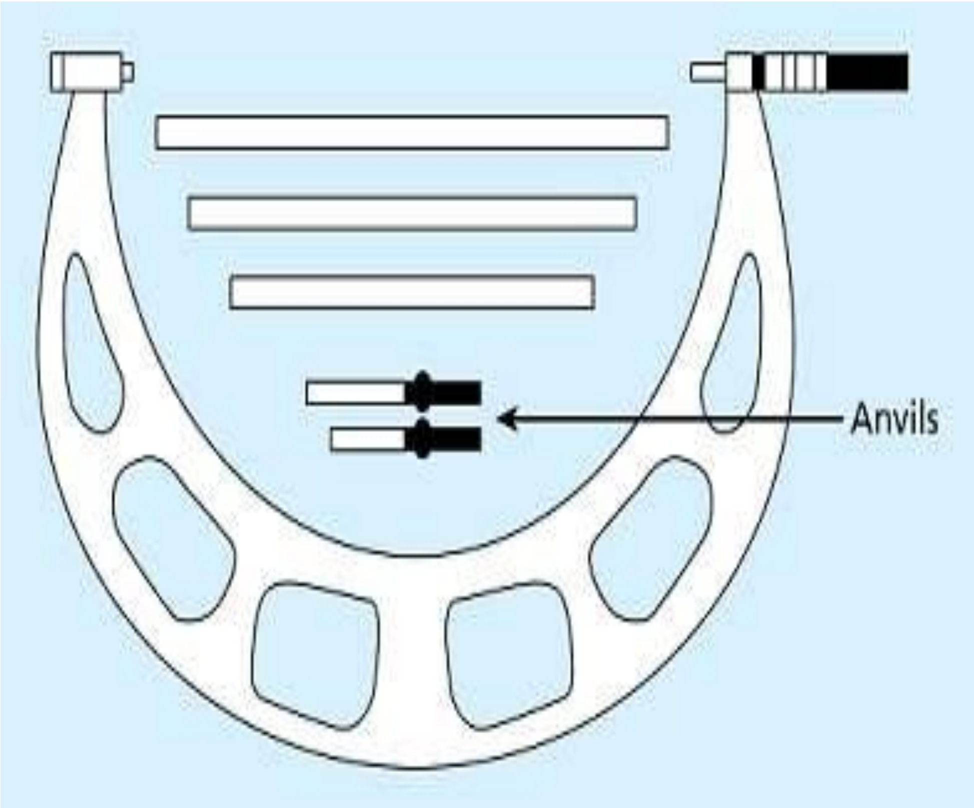


Fig. 11

3.6 **Miscellaneous accessories**

Another valuable and essential apparatus required while doing arrangement work is a measuring tape. This is a typical thing to most craftspeople, so a definite depiction is not required here. Your 6-inch pocket scale is likely the arrangement instrument you are most acquainted with. A considerable lot of your arrangement employments will be performed with this gadget. This kind of arrangement has its place, however it is not an accuracy strategy. A little reflect is another exceptionally supportive thing to have in your tool kit. It is exceptionally helpful when attempting to peruse a marker that may be situated in an area that is blocked off. Shims are likely the most imperative instrument utilized when performing arrangements. Fitting situation and exact thickness are the most essential components of utilizing shims. Utilizing pre-cut stainless-steel shims is quickly turning into the favoured method for rolling out vertical rise improvements. They are anything but difficult to utilize, speedy to introduce, and normally exact in their careful thickness.

Chapter -4
ALIGNMENT METHODS

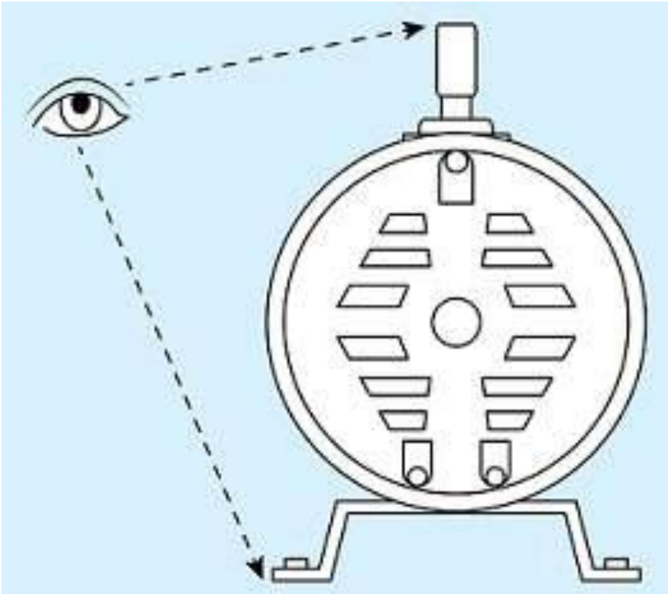
It is clear there are numerous strategies accessible today to adjust hardware. These strategies started more than 30 years prior. The idea of arrangement is not new; it is just not saw by a great many people who really perform the arrangement. The reason for this area is to acquaint the professional with the most widely recognized strategies utilized today. These systems will be portrayed in subtle element later in this manual. Likewise with any technique, there are potential wellsprings of mistake and in addition favourable circumstances. This area brings up a portion of the more striking perspectives for every strategy.

The methods that we are supposed to study here are:

- Visual Line-Up
- Feeler Gauge
- Rim and Face
- Cross Dial
- Reverse Dial
- Laser

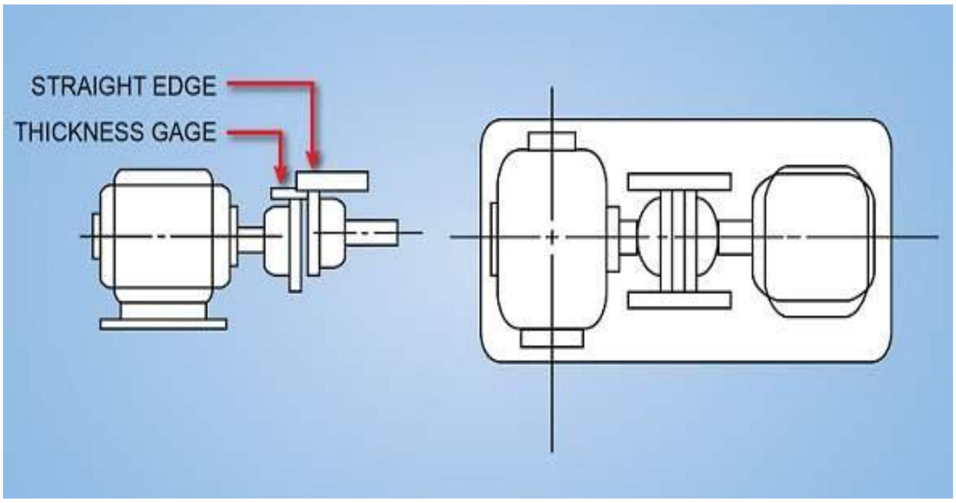
4.1 Visual Line Up

The visual line-up strategy, indicated in the figure underneath, is the most well-known technique for arrangement. Utilized as a part of starting establishments, visual line-up permits experts to investigate the working conditions and achievability of establishment. The method is quite reliable.



Feeler Gauge

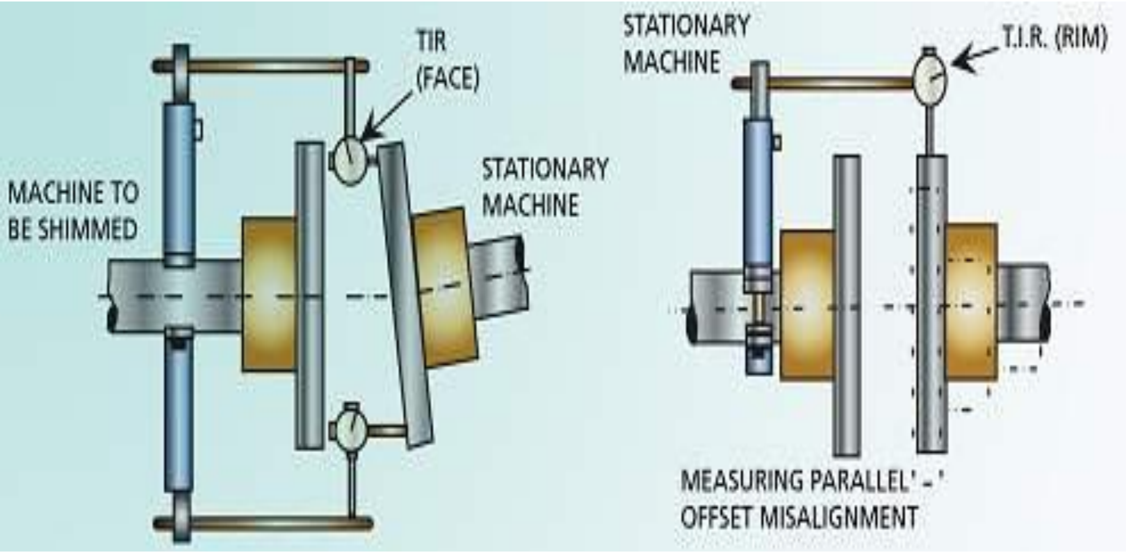
Straightedges are utilized to focus the balance between coupling parts; this is indicated in the figure shown below. Adjustments are made under every one of the four of the machines feet. Feeler gauges or taper gages measure the hole between coupling parts at the base and top of the coupling. The methodology is versatile and quite effective in its application.



Note: Corrections for angularity must be calculated and projected to the planes of the machine's feet for the proper shim change. This normally is a trial and error method, but it is useful for initial installations and rough alignment.

4.2 Rim and Face

This system is comparable in foremost to utilizing a straightedge and antenna gage, yet more exact since dial pointers are utilized. The edge perusing measures the balance between the coupling parts. The face perusing measures the rakish contrast between the characteristics of the coupling, as demonstrated in the figure appended. Changes are figured with the same recipe as the straightedge/feeler gage technique.



Advantages:

- Utilized when only one shaft can be turned.
- Given the right precautionary measures, accuracy arrangement is feasible with this system.

Drawbacks:

- End float influences face perusing.
- Pointer section (bar) list influences readings.
- Whimsical, skewed couplings or harmed surfaces will bring about lapses.
- Installation detachment causes lapses.
- Pointer stems not opposite to shaft causes lapses.

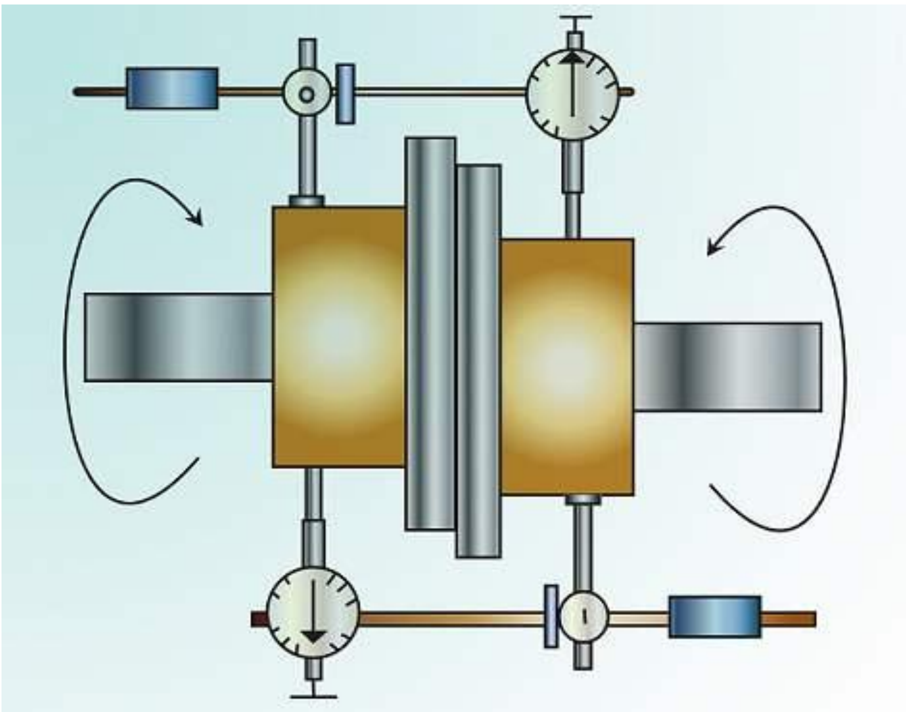
The indicators ought to be checked to guarantee that:

- The plungers are level, parallel to shafts, and discouraged about a large portion of their aggregate travel.
- The indicators are same separation from the pole pivot and precisely inverse one another when two markers are utilized.
- The contact focuses are halfway between coupling parts in the hub bearing.

In the event that hang free sections are not accessible, droop more noteworthy than .001 inch must be adjusted for.

4.3 Cross Dial

This strategy utilizes two dial pointers mounted precisely 180 separated to take shaft-to-shaft readings. Both parallel and precise misalignment may be adjusted for in the meantime. This strategy permits the couplings to stay appended, as the poles must move together. Figure underneath demonstrate an ordinary cross dial setup. The method is highly reliable, versatile and effective.



Points of interest:

- Extremely precise technique for utilizing dial markers.
- Simple and quick to utilize.
- Convenient.

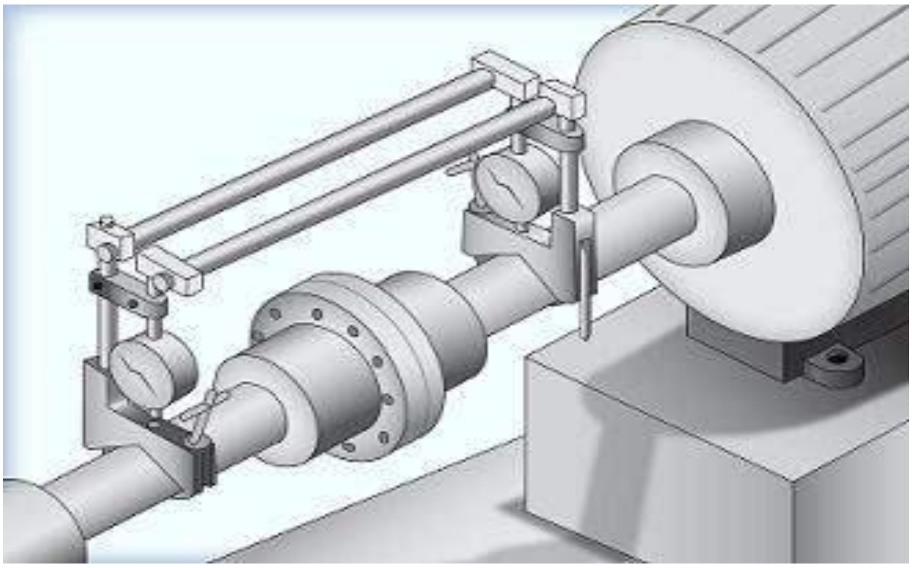
  - Graphical estimations for misalignment are non-specialized.

  - Computer or pocket mini-computers can likewise be utilized Sources of slip are:

- Indicator stems must be normal to the shaft.
- Detachment.
- Pointer section (bar) sag .
- Coupling recoil.
- Amazing pivotal buoy.
- Pointers that are not precisely inverse every others.

4.4 Reverse Dial

This technique utilizes two dial pointers that take shaft-to-shaft readings and is just about the same as the cross dial strategy, with the exception of that the markers are in the same plane with one another. Both the balance and angularity are consolidated in the arrangement estimation. This strategy, indicated in Figure 16, decides the misalignment by taking two edge readings at diverse focuses along the pole.



Preferences:

- Most accurate method of utilizing dial markers
- Simple and quick to utilize
- Straightforward:

-Graphical figuring for misalignment are non-specialized

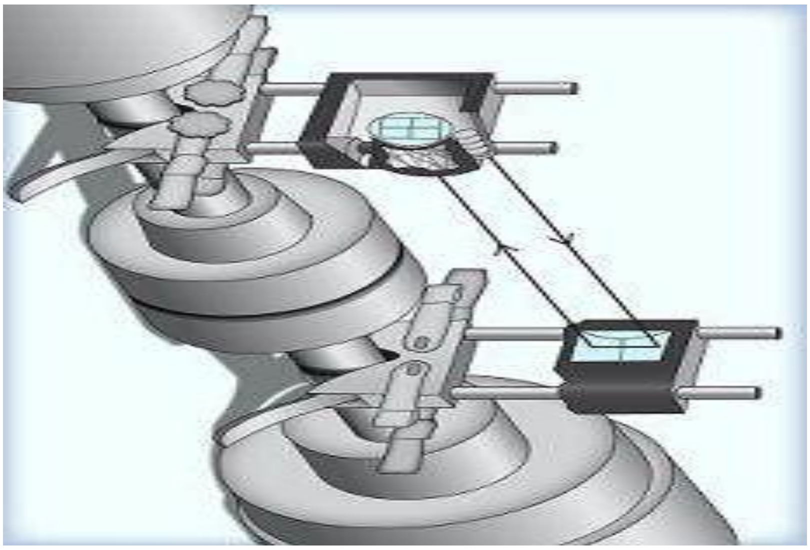
- Computer or pocket number crunchers can likewise be utilized

- Requires just 180 pivot Sources of blunder are:

- Marker stems not opposite to the pole
- Detachment
- Marker section (bar) hang
- Coupling backfire
- Great hub coast

4.5 Laser

The laser system for arrangement is like the edge and face technique, yet it uses light to compass the pole to-shaft separation. As both shafts are turned, the misalignment is controlled by the development of the laser shaft on the finder surface. This is indicated in Figure below.



Favourable circumstances:

- Most precise measuring gadget accessible
- Speed: with practice, arrangement computations can be made rapidly
- Wired to a PC
- Just obliges 180 pole pivot
- Level move capacities

Wellsprings of mistake are:

- Warmth/cool - air can misshape the laser and influence arrangement counts
- Detachment in sections or apparatuses.
- Coupling backfire

Legitimate shaft arrangement is obliged to keep up operational life span of all turning hardware. The two essential sorts of misalignment are parallelism and angularity. Both sorts can be found in the vertical and flat planes. To attain to our objective of fitting shaft arrangement, we must right for both sorts of misalignment. It has been noted in this segment that 50-55 to 70-75% of all vibration issues in turning hardware are created by misalignment. The general impact of this misalignment is lost generation, low quality of items, higher repair expenses, and expanded extra parts, all of which prompt decreased benefits. We additionally talked about the devices utilized as a part of arrangement. It is imperative that we know how to utilize these devices. In the segments that tail, we will figure out how to utilize the data and additionally the devices to legitimately adjust a bit of hardware. Additionally, each of the arrangement routines will likewise be talked about in point of interest later in this manual.

Chapter – 5

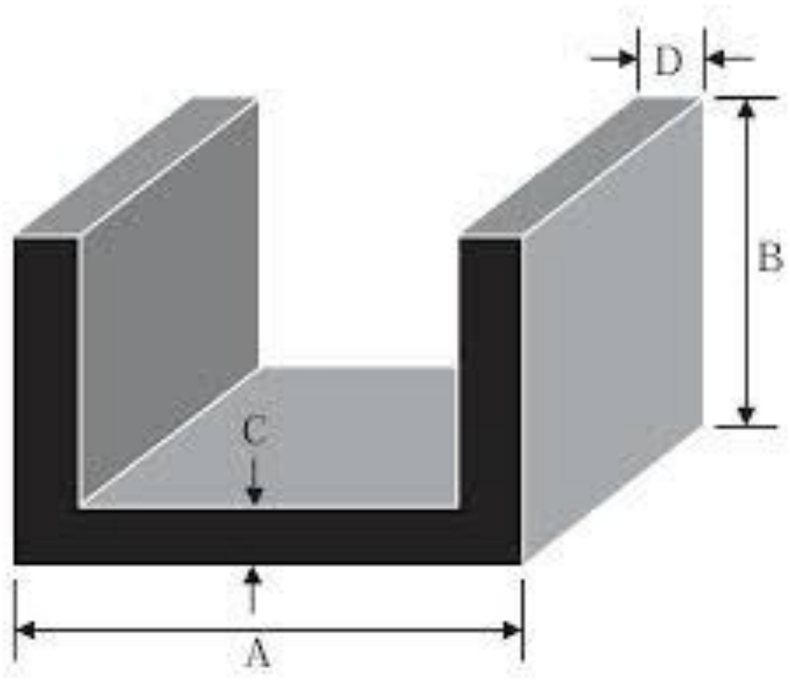
Methodology

5.1 Components used:

1. Channel

Dimensions of channel:

Length (Dimension)	No. of channels used
1 meter (4 inch * 2 inch)	2
3 inch (4 inch * 2 inch)	2
8 inch (6 inch * 3 inch)	4



Purpose of channel

The auxiliary channel is not utilized as much as a part of development as symmetrical shafts, to some degree in light of the fact that its twisting pivot is not focused on the width of the ribs. In the event that a heap is connected just as over its top, the shaft will have a tendency to contort far from the web. This may not be a powerless point or issue for a specific configuration, yet is a variable to be considered.

Channels or C-bars are regularly utilized where the level, posterior of the web can be mounted to another level surface for greatest contact range. They are likewise at times welded together consecutive to frame a non-standard I-pillar.

Hence, channel are the prominent source of providing support to the structural and vibrating members for the convenient and smooth operation.

2. Bearing

- **<u>Bearing used</u>** : Plummer block ball bearing

Inner diameter	Length	No. of bearings used
55 mm	55 mm	4

- ## Purpose of bearing

The motivation behind a metal ball is to lessen rotational contact and bolster spiral and hub loads. It accomplishes this by utilizing no less than two races to contain the balls and transmit the heaps through the balls. In many applications, one race is stationary and the other is connected to the pivoting get together (e.g., a center point or shaft). As one of the bearing races turns it causes the balls to turn too. Since the balls are moving they have a much lower coefficient of contact than if two level surfaces were sliding against one another.

Metal rings have a tendency to have lower burden limit for their size than different sorts of moving component orientation because of the littler contact zone between the balls and races. Nonetheless, they can endure some misalignment of the internal and external races.

3. Shafts:

Inner diameter	Outer diameter	No. of shafts used
55 mm	65 mm	2

- **Purpose of shafts**

A shaft is a rotating machine element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque (or twisting moment) set up within the shaft permits the power to be transferred to various machines linked up to the shaft. In order to transfer the power from one shaft to another, the various members such as pulleys, gears etc., are mounted on it. These members along with the forces exerted upon them causes the shaft to bending.

In other words, we may say that a shaft is used for the transmission of torque and bending moment. The various members are mounted on the shaft by means of keys or splines

4. **Spacer Shaft**:

Inner diameter	Hole diameter	No. of flange used
47 mm	5 mm	4

Purpose of spacer shaft:

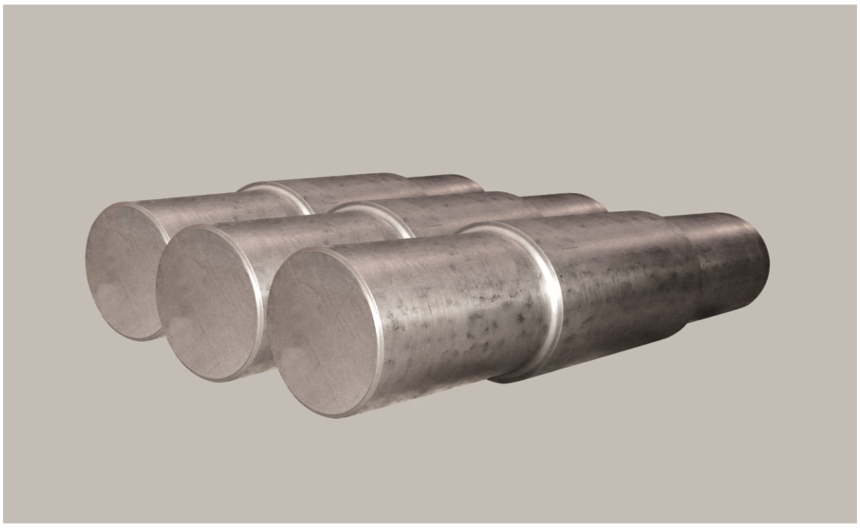
Spacer shaft serves as a connection between the driving and driven shaft between which the power is to be transferred. Diameter of the spacer shaft is generally taken as same as the flange plate diameter and input/ output shaft. Flange plates are mounted on the both sides of mating terminal which helps in the power transmission effectively without undergoing any rupture or breakdown. Spacer shaft is made up of GI pipe on which flanges are welded together on both the mating terminals.

These two flanges of GI pipe are connected to the flanges of the input and output shaft and holes were drilled on the flange plate in which nuts and bolts are tightened and advocates in successful power transfer. The power is first transmitted from the driving shaft to flange via weld which in turn is transmitted to the bolt mounted on the flange and the bolt further transmits this power to the flange mounted on the GI pipe then subsequently the power is transferred to the driven shaft.

5.2 Working Processes:

I. **Shaft Machining**:

The shaft were turned properly to a diameter of 65mm and then steps were made on the shaft accordingly to a diameter of 55mm at one end without the flange and were turned to a diameter of 47mm on the other end were flanges were supposed to be mounted.



II. **Fitting of Ball Bearing**:

Four ball bearings of apt diameter i.e 55mm were fitted properly into the ends of the shaft and the fitting was inflexible for the process of advocation of power transfer to the driving and driven shafts.

III. **Mounting of flange plates**:

Four flanges were mounted on the mating ends of the shaft via welding process . Four holes were made in the flange (Dia=5mm) using Drilling process.

IV. **Grinding of channels**:

To smoothen the surface and give a better surface finish to the channels, Grinding was done. Grinding enhances the perfection of the mating surafce so as to minimize the dynamic imbalance and redue the vibration simulataneously.

V. **Drilling of the Channels**:

8 holes of same diameter (dia=12mm) were drilled into the channel for the mounting of the C-Plate and give a base to the entire set up so that dynamic imbalance is reduced.

VI. **Tightening with Nuts and Bolts:**

Nuts and bolts of appropriate dimension were tightened into the perfectly aligned drilled holes of C-Channel and C-Plate to have a rigid base for the completion of the experiment without any errors or defect.

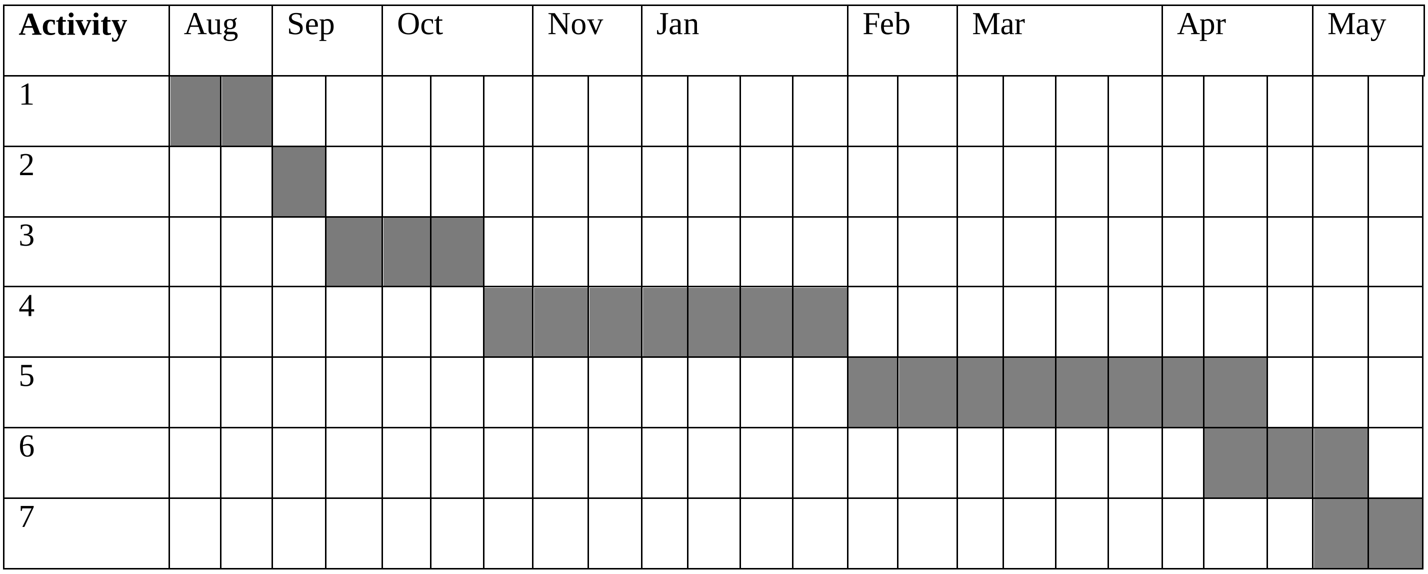
VII. **Welding of C-Channel** :

In order to maintain the constant gap betwwen the C-channels , two extra plates were welded on the both the ends to make it a frame or rigid structure and maintain the parallel or uniform gap. It also helps to eradicate any chance of misalignments due to vibration or any dynamic imbalance.

VIII. **Assembly of components**:

The final set up was prepared by the assembly of all the accessories and components to ensure the safe and efficient transmission of power without any rupture or problem. Each component were fitted properly and Bolts and Nuts of appropriate dimension were used to make the entire assembly along with the Machining process like welding , grinding , drilling , turning and Tightening. The final set up was prepared and side and front view of the assembly are shown below.

WORK SCHEDULE



Activities:-

1. Basic study of shaft alignment & misalignment
2. Basic study of alignment tools & alignment methods
3. Basic study of 'Flange coupling'
4. Designing & Buying experimental components (i.e. flange, bearing etc.)
5. Fabrication of the whole experimental set-up
6. Conduction of experiment
7. Result & conclusion

Chapter -6

RESULTS AND CONCLUSIONS

Agreeable and durable arrangement is accomplished by paying consideration on points of interest all through the configuration, creation and establishment of the device. Toward this end, the accompanying are negligible necessities:

- Turning equipment that is legitimately planned and well made.
- A very much planned and legitimately executed framework into which the equipment is incorporated.
- Educated, watchful and experienced skilled worker.
- Legitimate preparing of both specialist and supervisory faculty.
- Suitable apparatus.
- Gauges and/or particulars enumerating arrangement necessities.
- A framework to guarantee that occupation particulars are taken after.

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